

WASHING MACHINE WITH A PRESSING AND/OR IRONING FUNCTION AND  
METHOD FOR CLEANING LAUNDRY

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Cross-Reference to Related Application:

This application is a continuation of copending International Application No. PCT/EP01/14907, filed December 17, 2001, which designated the United States and was not published in English.

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Background of the Invention:

Field of the Invention:

The invention relates to a washing machine having a housing and measures for producing an air stream and a method for  
15 cleaning laundry.

The prior art discloses washing machines in the form of commercially available household washing machines. Such household washing machines, for the purpose of moving the  
20 laundry, have a laundry drum into which washing liquid is dispensed. The dirt released from the laundry is, then, transported away in a rinsing operation.

Household washing machines may also be equipped with an  
25 integrated dryer, which usually operates by the condensation or circulating-air principle.

Once the laundry has been washed and dried, it has to be removed from the laundry drum and can, then, be ironed by hand. The prior art also discloses configurations for the automatic pressing of laundry, although these are suitable predominantly just for the industrial sector.

German Patent DE 29 29 057 C2, corresponding to United States Patent No. 4,346,826 to Ehemann, discloses a configuration for steaming pullovers, jackets, and similar items of clothing. In this configuration, an inflatable steaming dummy, which is modeled on the item of clothing that is to be handled, is in flow connection with a fan, which is fitted on the underside of the steaming dummy, and heated air or steam can be blown into the cavity of the steaming dummy through a broad-jet nozzle by way of feed lines and a heating element connected therebetween.

German Published, Non-Prosecuted Patent Application DE 199 13 647 A1 discloses a configuration for drying and/or pressing dampened laundry, in particular, shirts. The configuration has a device for aligning the laundry and a heating device, which is associated with a fan. The heating device has at least one heat accumulator. As a result, heat energy is stored, for example, as the laundry is aligned, and is available at the

beginning of the handling operation and during the same. This configuration should also be suitable for household use.

German Patent DE 35 07 757 C2 discloses an industrial machine  
5 for steaming and pressing items of clothing. For such a purpose, a bearing device, which is partly modeled on the cut, for example, of a shirt, and a clamping configuration for the border regions of the item of clothing are provided for aligning the item of clothing in the correct position in  
10 relation to the cut, it being possible for these to be adapted to different sizes. Under the action of steam and/or drying air, the item of clothing is shaped in accordance with its own cut and handled using dimensionally stable equipment, shaping elements, and a steaming bag which has steam flowing through  
15 it.

German Published, Non-Prosecuted Patent Application DE 197 30  
358 A1 discloses a development of the above-mentioned steaming and pressing machine, which is intended to allow uniform  
20 pressing at all locations of the item of laundry.

As set for below, the prior art also discloses washing, drying, and pressing configurations for industrial laundry purposes.

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United States Patent No. 5,502,988 to Shimazaki et al.

discloses an industrial cleaning configuration having a conveying chain for transporting the laundry through the various washing-process steps. Furthermore, United States

5 Patent No. 4,412,435 to Gallagher discloses a continuously operating cleaning installation. The cleaning installation has a configuration for subjecting the laundry to mechanical action. A corresponding installation is also known from United States Patent No. 4,361,018 to Gallagher.

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Netherlands Patent Document NL 10 05 069 C2 discloses an industrial hot mangle that is intended for drying and ironing laundry and has an endless conveying belt. The conveying belt is guided, in part, along an evaporating configuration.

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Japanese Patent Document JP-A-10118398 discloses a drying, pressing and ironing configuration that is intended for washed laundry and has a belt for absorbing the moisture and rollers for transporting the laundry.

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Japanese Patent Document JP-A-5337300 discloses an industrial washing configuration with a conveyor that conveys the laundry through the various washing-process steps in the installation.

25 United States Patent No. 5,439,768 to Matsuo et al. discloses a conveyor that is intended for moving laundry and, in which

the laundry that is to be conveyed is coupled to the conveying belt by fastening clips.

German Published, Non-Prosecuted Patent Application DE 32 16

5 195 A1, corresponding to United States Patent No. 4,425,842 to Winch et al., discloses a mangle in which, by a conveying belt, the laundry is pressed against a roller to carry out preliminary water removal.

10 Summary of the Invention:

It is accordingly an object of the invention to provide a washing machine with a pressing and/or ironing function and a method for cleaning laundry that overcome the hereinafore-mentioned disadvantages of the heretofore-known devices and  
15 methods of this general type and that has an integrated pressing and/or ironing function.

With the foregoing and other objects in view, there is provided, in accordance with the invention, a washing machine  
20 for cleaning laundry items, including a housing, an air stream device disposed at the housing for producing an air stream, a transporting device disposed in the housing for moving at least one item of laundry within the housing, and an air stream directing device disposed in the housing for directing  
25 the air stream into at least one of the laundry items disposed in the housing. Preferably, the housing is a cabinet.

The invention allows the automatic pressing and/or ironing of laundry following the washing operation, without the laundry having to be removed from the washing machine.

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This makes the work of the user - particularly in the household - quite considerably easier.

Before the washing operation is carried out, the item of laundry that is to be washed is fixed, within the housing of the washing machine, on a support, through which, following completion of the washing operation, a hot stream of compressed air is directed into the item of laundry. As a result, the item is pressed. As an alternative, or in addition, it is also possible for the hot air stream to be directed into the item of laundry from beneath, e.g., through additional nozzles.

In accordance with another feature of the invention, the transporting device transports at least one of the laundry items to direct at least some of the air stream into the at least one laundry item.

The items of laundry that are to be washed and ironed are, advantageously, positioned on hanger-like supports, which are, then, hung in the washing machine. The hanger-like supports

may be internally hollow for the purpose of directing the stream of compressed air into the item of laundry.

In accordance with a further feature of the invention, the  
5 transporting device has a bearing device with a shape corresponding to a shape of the laundry item to be processed and the bearing device is fluidically connected with the air stream device.

10 As an alternative, or in addition, it is also possible for supports for items of laundry to be disposed in a fixed or moveable manner in the washing machine. As a result, the act of drawing the items of laundry onto the corresponding supports takes place directly in the washing machine. The  
15 supports here may be in the form of a steaming dummy or of a clamping and/or tensioning configuration.

In accordance with an added feature of the invention, a further fan is, advantageously, disposed in the housing of the  
20 washing machine. As a result, an air stream can also be applied from the outside for the purpose of pressing the item or items of laundry. The corresponding counter-pressure optimizes the pressing and/or ironing function.

25 In accordance with an additional feature of the invention, advantageously, there is provided, in the washing machine, a

controllable conveying configuration, for example, a conveying belt or a conveying chain, on which the supports for the items of laundry can be fixed. Depending on the processing operation that is to be carried out, within the washing machine, it is possible for the conveying configuration to keep the items of laundry stationary, move them into a constant-speed circulatory path or allow them to execute a reciprocating movement. Using the conveying apparatus is advantageous, in particular, also for carrying out the washing operation. The laundry is, then, guided, by the conveying configuration, past various nozzles disposed in the washing machine, for example, for wetting the laundry, for spraying the washing liquid onto the laundry and for supplying rinsing water to the laundry so that released particles of dirt are transported away.

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In accordance with yet another feature of the invention, there is provided a liquid dispenser disposed in the housing for applying washing liquid to the at least one laundry item disposed in the housing, the liquid dispenser having at least one nozzle for spraying the washing liquid onto the at least one laundry item disposed in the housing.

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In accordance with yet a further feature of the invention, there is provided a rinsing device disposed in the housing for supplying rinsing water to the at least one laundry item disposed in the housing.

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In accordance with yet an added feature of the invention,  
there is provided a water removal device disposed in the  
housing for preliminary removal of water from the at least one  
5 laundry item disposed in the housing.

In accordance with yet an additional feature of the invention,  
there is provided an integrated drying configuration disposed  
in the housing for drying the at least one laundry item  
10 disposed in the housing.

With the objects of the invention in view, there is also  
provided a washing machine, including a housing, means for  
producing an air stream disposed at the housing, means for  
15 carrying at least one item of laundry within the housing, and  
means for directing the air stream into the laundry items  
disposed in the housing.

With the objects of the invention in view, there is also  
20 provided a washing machine for cleaning laundry items,  
including a housing, an air stream device disposed at the  
housing for producing an air stream, a transporting device  
disposed in the housing for moving at least one item of  
laundry within the housing, transporting device having bearing  
25 devices each with a shape corresponding to a shape of the  
laundry item to be processed, at least one of the bearing

devices being fluidically connected with the air stream device, an air stream directing device disposed in the housing for directing the air stream into at least one of the laundry items disposed in the housing, a second air stream device for  
5 producing a second air stream, the second air stream device being disposed in the housing and directing the second air stream onto an outer side of the at least one laundry item in the housing, a controllable conveying configuration disposed in the housing, at least one of the bearing devices being  
10 coupled to the conveying configuration, the conveying configuration at least one of keeping the at least one laundry item stationary, moving the at least one laundry item into a constant-speed circulatory path, and executing a reciprocating movement dependent upon a respective one of the processing  
15 operations, a wetting device disposed in the housing for wetting the at least one laundry item disposed in the housing, a liquid dispenser disposed in the housing for applying washing liquid to the at least one laundry item disposed in the housing, the liquid dispenser having at least one nozzle  
20 for spraying the washing liquid onto the at least one laundry item disposed in the housing, a rinsing device disposed in the housing for supplying rinsing water to the at least one laundry item disposed in the housing, a water removal device disposed in the housing for preliminary removal of water from  
25 the at least one laundry item disposed in the housing, and an

integrated drying configuration disposed in the housing for drying the at least one laundry item disposed in the housing.

With the objects of the invention in view, there is also  
5 provided a method of at least one of pressing and ironing at least one laundry item, including the steps of placing the at least one laundry item in a washing machine having at least one of an integrated pressing function and an ironing function, passing hot, moisture-loaded compressed air over the  
10 at least one laundry item, and passing hot, dry compressed air over the at least one laundry item.

Prior to the pressing and/or ironing operation, preliminary water removal is, advantageously, executed first. This can be  
15 done by a drying configuration that is integrated in the washing machine, and operates, for example, by the condensation or ventilation principle.

To carry out the pressing and/or ironing operation, in  
20 accordance with again another mode of the invention, it is advantageous for the items of laundry to be moved, by the conveying configuration in the housing, past the warm-air nozzles fastened in the inside of the housing to ensure, on average, uniform exposure of the surfaces of the items of  
25 laundry to air.

In accordance with again a further mode of the invention, it is advantageous, first of all, to pass hot and moisture-laden compressed air over the items of laundry. Thereafter, hot and dry compressed air is passed over them. The supply of cold and dry air advantageously, then, takes place to shorten the period of time until the user can safely open the washing machine.

A preferred embodiment makes use of a pair of rollers disposed along the circulatory path in the housing and intended for the preliminary removal of water from the laundry. The laundry is drawn through the pair of rollers by the conveying configuration. As a result, the rinsing water located in the laundry is squeezed out at least in part.

In accordance with again an additional feature of the invention, the preliminary water removal takes place by virtue of the laundry being pressed against an absorbent nonwoven. The laundry is, preferably, pressed against the nonwoven, in a region of the circulatory path, by a roller, and is simultaneously drawn further by the conveying configuration.

The nonwoven absorbs water from the laundry at least in a region where the roller exerts pressure, water, thus, being removed from the laundry on a preliminary basis.

In accordance with a concomitant feature of the invention, the preliminary removal of water from the laundry takes place by hot or cold compressed air. The preliminary water removal may take place both by the ventilated-dryer principle and by the  
5   condensation-dryer principle.

Following completion of the washing, drying and pressing and/or ironing operation, the laundry can be moved directly from the washing machine, for example, into a wardrobe because  
10   the laundry is already in a ready-for-use position; this can also be done by a machine.

As a result, the invention, thus, allows fully automatic laundry care in a single household appliance.  
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Other features that are considered as characteristic for the invention are set forth in the appended claims.

Although the invention is illustrated and described herein as  
20   embodied in a washing machine with a pressing and/or ironing function, it is, nevertheless, not intended to be limited to the details shown because various modifications and structural changes may be made therein without departing from the spirit of the invention and within the scope and range of equivalents  
25   of the claims.

The construction and method of operation of the invention, however, together with additional objects and advantages thereof, will be best understood from the following description of specific embodiments when read in connection  
5 with the accompanying drawings.

Brief Description of the Drawings:

FIG. 1 is a cross-sectional view through a washing machine according to the invention with an ironing function, the  
10 section running parallel to a plane of the conveying belt; and

FIG. 2 is a perspective view of a preferred embodiment of the washing machine according to the invention with an ironing function.

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Description of the Preferred Embodiments:

Referring now to the figures of the drawings in detail and first, particularly to FIG. 1 thereof, there is shown a washing machine 1 that has a cabinet-like housing 2. The  
20 housing 2 may be, for example, up to 2 m in height. The rest of the dimensions of the washing machine 1, preferably, correspond to those of conventional household washing machines.

25 Located in the housing 2 is an endless conveying belt 3, which is driven, deflected and controlled by way of a non-

illustrated motor of the washing machine 1, through non-illustrated rollers or gearwheels. As an alternative, it is also possible for the conveying configuration to be realized, for example, as a conveying chain.

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Formed in or on the conveying belt 3 is a compressed-air directing device, for example, a cavity, which serves for directing hot compressed air. The cavity in the conveying belt 3 is connected to a compressor through a non-illustrated compressed-air line. The conveying belt 3 has recesses 4 in which hanger-like supports 6 can engage. Each of the hanger-like supports 6 has a hook, which has an internal cavity for directing the compressed air. If the hanger-like carrier is hung in a recess 4 of the conveying belt 3 by way of its hook, this produces a flow connection between the conveying belt 3 and the hanger-like carrier 6. As a result, the hot air directed in the cavity of the conveying belt 3 can flow, through the hook, into the hanger-like support 6, out of which it passes through distributed nozzle openings to subject an item of laundry 5 located on the hanger-like support 6, for example, a shirt or a blouse, to the action of hot compressed air from the inside, that is to say, as it were, "inflated." Prior to the washing operation, individual items of laundry are hung respectively on a hanger-like support 6, whereupon the support 6 is hung in a recess 4 of the conveying belt 3 by way of its hook.

Located on the inner side of the housing 2 are spray nozzles 7 for spraying water onto the laundry 5. Also disposed on the inner side of the housing 2, along the conveying belt 3, are cleaning nozzles 8 for spraying washing liquid onto the laundry. Located beneath the cleaning nozzles 8 are rinsing nozzles 20 for spraying rinsing water onto the laundry 5. As a result, the dirt released is rinsed out of the laundry 5.

10 Located on the opposite inner side of the housing 2, in a region of the conveying belt 3, is a warm-air forced-draft fan 9 for passing warm or hot air over the laundry 5. Located above the warm-air forced-draft fan 9 is an absorbent nonwoven 10, which is guided over rollers 11 and 12. At least one of the rollers 11 or 12 may be driven to move the nonwoven, in its parallel region oriented directly toward the conveying belt 3, substantially synchronously with a circulatory movement of the conveying belt 3.

20 A fan 13 is also located in the housing 2. The fan 13 can serve for taking in air or for blowing out waste air. Located in the rear wall of the housing 2 is a heat exchanger 14, which is, advantageously, configured as a rinsing container. The rinsing container, thus, on one hand, has the function of storing water for the rinsing operations and, at the same time, serves as a condenser for condensing the water absorbed



from the laundry 5 by way of the compressed air. The water located in the rinsing container is preheated by the heat exchange with the condensing steam. This makes it possible to reduce the energy absorption of the washing machine 1.

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In the bottom region of the housing 2, a lint filter 15 is located in a washing-liquid-collecting container 22, which serves for intercepting water. Located beneath the washing-liquid-collecting container 22 is a circulating pump 16 for wetting and/or spraying the laundry 5 through the spray nozzles 7 and/or the cleaning nozzles 8 and also a discharge pump 17 for transferring or for pumping away washing liquid through the hose 18.

15 A heater in the form of heating coils is located in a front region of the housing 2, beneath and/or above a door opening in the housing 2. The heating coils are not shown in FIG. 1.

To prepare for the washing operation, the laundry 5 is, first, hung in the conveying belt 3 by way of the hanger-like supports 6.

The detergent is supplied into the washing-liquid-collecting container 22 through a detergent-feeder. This can take place, through a supply-and metering-container combination, by the dispensing-tray principle.

Once the washing program has started, the detergent dissolves in the water bath and is guided to the cleaning nozzles 8 at a given time through the circulating pump 16.

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For a washing program to be carried out, the conveying belt 3, in a first step, is made to circulate, to be precise corresponding to the movement direction shown by the arrows 19. The circulatory speed of the conveying belt 3, and, thus, 10 of the laundry 5 transported by the conveying belt 3, corresponds to the respectively necessary washing-process speed.

The spray nozzles 7 wet the passing laundry 5 to dampen it, 15 and, thus, to accelerate the absorption of detergent into the laundry 5.

In a second step, the laundry passes the cleaning nozzles 8, by which washing liquid is sprayed onto the laundry 5. The 20 washing liquid soaks the laundry 5 and, thus, releases the dirt.

In a third step, clean water is sprayed into the passing laundry 5 from the rinsing nozzles 20 to transport the dirt 25 and the washing liquid away.

Sensors fitted in the housing 2 can be used to check the success of the cleaning of the laundry 5 and to measure and, if appropriate, evaluate the turbidity of the washing liquid. If the degree of cleaning is not sufficient, then the above-mentioned steps can be repeated as often as necessary.

The washing liquid and/or the rinsing water drips from the wet laundry 5 into the washing-liquid-collecting container 22 and, from there, is circulated to the cleaning nozzles 8 and/or pumped away through the discharge pump 17. In principle, it is not necessary, in the case of the washing machine 1, for the laundry 5 to be introduced into the washing liquid 23 located in the washing-liquid-collecting container 22; rather, in the exemplary embodiment shown, washing liquid is applied to the laundry 5 solely through the cleaning nozzles 8.

For improved water exchange, the laundry 5 can be moved against an abutment. Furthermore, it is possible for the water-exchange and/or the water-discharge process to be intensified and accelerated with the aid of pairs of rollers.

Completion of the wet phase, in which the laundry is washed, is followed by the drying phase. Once the clean-water supply to the rinsing nozzles 20 has been switched off, dry, heated compressed air for the drying process is guided onto the laundry through a compressor or the fan 13. Additional

circulatory or reciprocating movement of the laundry 5 by way of the conveying belt 3 makes it possible to shorten the drying time as a result of the associated intensive air exchange with the air located in the housing 2.

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Prior to the actual drying of the laundry 5, preliminary removal of water from the laundry 5 is, advantageously, carried out.

10 In a first embodiment, which is not shown in FIG. 1, a pair of rollers, controlled electronically by spacer sensors, thus, moves from both sides against the laundry 5 moved by the conveying belt 3. As a result, the laundry 5 is drawn through the pair of rollers. By virtue of the contact pressure of the  
15 pair of rollers on the laundry 5 located therebetween, water is forced out of the laundry 5 and drips back into the washing-liquid-collecting container 22. Instead of a pair of rollers, it is also possible to provide a roller chain. As a result, the laundry 5, rather than being drawn through the  
20 pair of rollers, is drawn through a roller chain disposed on both sides of the laundry 5.

In the case of the preferred embodiment that is shown in FIG. 1, the laundry 5, as soon as it has reached the region of the  
25 nonwoven 10, is pressed against the nonwoven 10 by a roller 24. The roller 24, thus, moves in the direction of the arrow

25 to press the laundry 5 against the nonwoven. At the location where the roller 24 comes into contact with the laundry 5, the laundry 5 is forced by contact pressure against the nonwoven 10. As a result, the water located in the laundry 5 is absorbed at this location, at least in part, by the nonwoven 10. At the same time, the conveying belt moves the relevant laundry 5 further along the movement direction of the arrow 19. As a result, the region in which the roller 24 comes into contact with the laundry 5, likewise, changes.

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Parallel to the movement of the conveying belt 3 and of the corresponding laundry 5, the nonwoven 10, which is guided over the rollers 11 and 12, also moves further. This has the advantage that, wherever the laundry 5 is pressed against the nonwoven 10 by the roller 24, a still dry, and, thus, absorbent, region of the nonwoven 10 is present. It is possible for the water absorbed in the nonwoven to be squeezed out, for example, through a further pair of non-illustrated rollers, as the water-soaked nonwoven returns on the side that is oriented directly toward the housing 2.

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According to a further preferred embodiment, the preliminary water removal may take place by dry compressed air that is supplied directly to the laundry. Through the warm-air forced-draft fan, the dry air is applied to the laundry in a uniformly distributed manner. It is also possible for the

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laundry to be fixed, for example, between non-illustrated grids as the compressed air is supplied. The compressed air is, advantageously, supplied in a process-controlled manner in sub-steps.

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The above-mentioned steps may take place in combination or one after the other - also with repetition - in order to achieve an optimum cleaning effect.

10 Completion of the washing operation and, if appropriate, of the preliminary water removal and/or drying operation is followed by the pressing and/or ironing operation. For such a purpose, hot compressed air is directed, through the conveying belt 3 and the hanger-like supports 6 hung in the conveying  
15 belt 3, into the laundry 5 fastened on the supports. As a result, the latter are subjected to the action of a stream of compressed air from the inside. At the same time, the warm-air forced-draft fan 9 and/or the fan 13 pass/passes hot moisture-laden compressed air over the laundry 5. The laundry 5 is  
20 moved into a circulatory path by the conveying belt 3. As a result, it executes a reciprocating movement or circulates in the housing 2.

In a subsequent process step, hot, dry compressed air is  
25 passed over the laundry 5. As a result, the actual pressing and/or ironing operation are completed. Following completion

of the pressing and/or ironing operation, it is advantageous for cold, dry air to be passed over the laundry 5 to cool it. By virtue of the cooling operation being shortened, it is possible for the door of the washing machine to be opened more quickly and, thus, for the amount of time required for the entire laundry-care process to be shortened further.

FIG. 2 shows a further preferred embodiment of the washing machine according to the invention. For the elements of FIG. 2 that correspond to the embodiment of FIG. 1, use is made of the same designations as in FIG. 1.

In the case of the embodiment of FIG. 2, the conveying belt 3 is a two-part configuration. Only the rear part of the conveying belt 3 is illustrated in FIG. 2. Located between the two parts of the conveying belt 3 are supports 26, on which laundry 5 can be hung. These supports 26 are internally hollow for the purpose of directing compressed air. Through a compressor, it is possible for hot air to be blown, through the supports 26, into the laundry 5 hanging on the supports 26.

Warm-air forced-draft fans 9 are disposed along an inner side of the housing 2. To realize the pressing and/or ironing function, hot air is blown into the laundry 5 through the supports 26. As a result, the laundry 5 is subjected

internally to the pressure of hot air. At the same time, the laundry is moved past the warm-air forced-draft fans 9 in the direction of the arrow 19 by way of the movement of the conveying belt 3. As a result, the laundry 5 is also  
5 subjected externally to air pressure so that a counter-pressure is produced. This results in the desired pressing and ironing effect.

Following completion of the pressing and ironing operation,  
10 the laundry 5 is in a ready-for-use position. It can be moved mechanically, by a machine, from the washing machine 1 into a wardrobe or linen cupboard.

As an alternative, or in addition, to the hanger-like supports  
15 6 and 26, it is also possible to hang, in the conveying belt 3, a steaming dummy and/or a clamping and/or tensioning configuration, through which compressed air is directed into the interior of the laundry 5.